MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2015/2016

PPS 0025 – INTRODUCTION TO PROBABILITY AND STATISTICS

(All sections / Groups)

2 MARCH 2016
2.30 p.m – 4.30 p.m
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of THREE **printed** pages excluding cover page.
2. Attempt **ALL** FOUR questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the answer booklet provided. All necessary working steps **MUST** be shown.
4. **Statistical table** is provided.

Question 1 (25 marks)

a. Two dice are rolled and we define the sample space as

$$S = \{(1,1),(1,2),(1,3),.....(6,6)\}$$

Let X denote the random variable whose value for any element of S is the sum of the numbers on the two dice.

i. How many elements are there in the sample space of rolling two dice? (1 mark)

ii. Find the possible values of X. (2 marks)

iii. Calculate $P(X > 13)$. (1 mark)

b. The random variable X has probability density function

$$f(x) = \begin{cases} ax+1 & , \quad 0 < x < 1 \\ bx & , \quad 1 \le x < 2 \\ 0 & , \quad \text{otherwise} \end{cases}$$

If the mean of X, $E(X)$ is $\frac{11}{6}$, find the

i. values of a and b. (13 marks)

ii. cumulative distribution of X and use it to evaluate $P(0.8 < X < 1.5)$. (8 marks)

Question 2 (25 marks)

a. Accuracy in taking orders at a drive-through window is important for fast-food chains. Each month, *QSR Magazine*, **www.qsrmagazine.com,** publishes the results of its surveys. Accuracy is measured as the percentage of orders that are filled correctly. In a recent month, the percentage of orders filled correctly at McDonald's was approximately 91%. Suppose that you and ten friends go to the drive through window at McDonald's and independently place orders,

i. what is the probability that at least 7 orders will be filled correctly? (3 marks)

ii. what is the probability that between 3 and 9 orders will be filled correctly? (4 marks)

iii. what is the probability that not more than 5 orders will **NOT** be filled correctly? (2 marks)

Continued ...

b. A toll free phone number is available from 9 a.m. to 9 p.m. for your customers to register complaints about a product purchased from your company. Past history indicates an average of 0.4 calls are received per minute.

i. What is the probability that two or more calls will be received during a 1-minute period? (3 marks)

ii. What is the probability that exactly 20 calls will be received during a 35-minute period? (3 marks)

iii. Find the mean of the number of calls received in a given day. (2 marks)

c. Many manufacturing problems involve the matching of machine parts, such as shafts that fit into a valve hole. A particular design requires a shaft with a diameter of 22.000mm, but shafts with diameters between 21.900mm and 22.010mm are acceptable. Suppose that the manufacturing process yields shafts with diameters normally distributed, with a mean of 22.002mm and a standard deviation of 0.005mm. For this process, what is

i. the probability that a shaft is acceptable? (3 marks)

ii. the diameter that will be exceeded by only 2% of the shafts? Leave your answer in 4 decimal places. (5 marks)

Question 3 (25 marks)

a. The prices of all 6 toys bought by a nursery teacher are as below:

50.50 18.99 36.35 42.40 44.39 16.90

Construct the sampling distribution of sample mean with samples of size five, which can be selected without replacement from this population. Then, find the sampling error for each sample. (13 marks)

b. The population mean annual salary for plumbers is RM46,700 with a standard deviation of RM5,600. A random sample of 42 plumbers is drawn from this population.

i. Calculate the mean, $\mu_{\bar{x}}$ and the standard deviation, $\sigma_{\bar{x}}$ of the sampling distribution. (3 marks)

ii. What is the probability that the mean salary of the sample is within RM2,000 from the population mean? (5 marks)

iii. What is the probability that the mean salary of the sample is more than the population mean by at least RM1,500? (4 marks)

Continued ...

Question 4 (25 marks)

a. According to a study, households that own pet spend an average of RM1575 per year on veterinary care. Assume that this average is based on a random sample of 50 such pet owners and that the sample standard deviation is RM215.

i. What is the point estimate of the population mean? (1 marks)

ii. What is the margin of error for this estimate? (2 marks)

iii. Construct a 97% confidence interval for the mean annual expenditure on veterinary care for all such pet owners. (5 marks)

iv. Suppose the confidence interval obtained in part (iii) is too wide. How can the width of this interval be reduced? Discuss all possible alternatives. Which alternative is the best? (2 marks)

b. A clinic offers a weight-loss program. A review of its records found the following amount of weight loss in pounds, for a random sample of 10 of its clients at the end of the program:

18	25	6	11	15	20	16	19	12	17

If the population variance is 5.03, construct a 90% confidence interval for the population mean. (7 marks)

c. A manufacturer of chocolate candies uses machines to package candies as they move along a filling line. Although the packages are labeled as 8 ounces, the company wants the packages to contain a mean of 8.17 ounces so that virtually none of the packages contain less than 8 ounces. A sample of packages is selected periodically and the packaging process is stopped if there is evidence that the mean amount packaged is different from 8.17 ounces. Suppose that in a particular sample of 50 packages, the mean amount dispensed is 8.159 ounces, with a sample standard deviation of 0.051 ounces. At the 0.05 level of significance, is there evidence that the population mean amount is different from 8.17 ounces?

(8 marks)

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